

Experimental Studies of Sigma Thin-Walled Beams Strengthened by CFRP Tapes

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Abstract : The review of selected methods of strengthening of steel structures with carbon fiber reinforced polymer (CFRP) tapes and the analysis of influence of composite materials on the steel thin-walled elements are performed in this paper. The study is also focused to the problem of applying fast and effective strengthening methods of the steel structures made of thin-walled profiles. It is worth noting that the issue of strengthening the thin-walled structures is a very complex, due to inability to perform welded joints in this type of elements and the limited ability to applying mechanical fasteners. Moreover, structures made of thin-walled cross-section demonstrate a high sensitivity to imperfections and tendency to interactive buckling, which may substantially contribute to the reduction of critical load capacity. Due to the lack of commonly used and recognized modern methods of strengthening of thin-walled steel structures, authors performed the experimental studies of thin-walled sigma profiles strengthened with CFRP tapes. The paper presents the experimental stand and the preliminary results of laboratory test concerning the analysis of the effectiveness of the strengthening steel beams made of thin-walled sigma profiles with CFRP tapes. The study includes six beams made of the cold-rolled sigma profiles with height of 140 mm, wall thickness of 2.5 mm, and a length of 3 m, subjected to the uniformly distributed load. Four beams have been strengthened with carbon fiber tape Sika CarboDur S, while the other two were tested without strengthening to obtain reference results. Based on the obtained results, the evaluation of the accuracy of applied composite materials for strengthening of thin-walled structures was performed.

Keywords : CFRP tapes, sigma profiles, steel thin-walled structures, strengthening

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